NEMOS System Components & Typical Procedures

NEMOS

Wave, Wind, & Water Level Editor

WIS Phase III Transformation

Wave Statistical Analysis and Visualization

Spectra Generation

Grid Generation

STWAVE

Wave Model Visualization

GENESIS

Tidal Current Editor

GENESIS/T
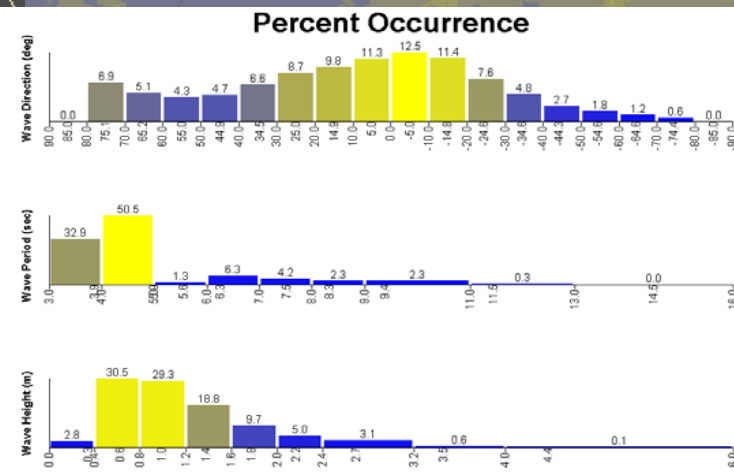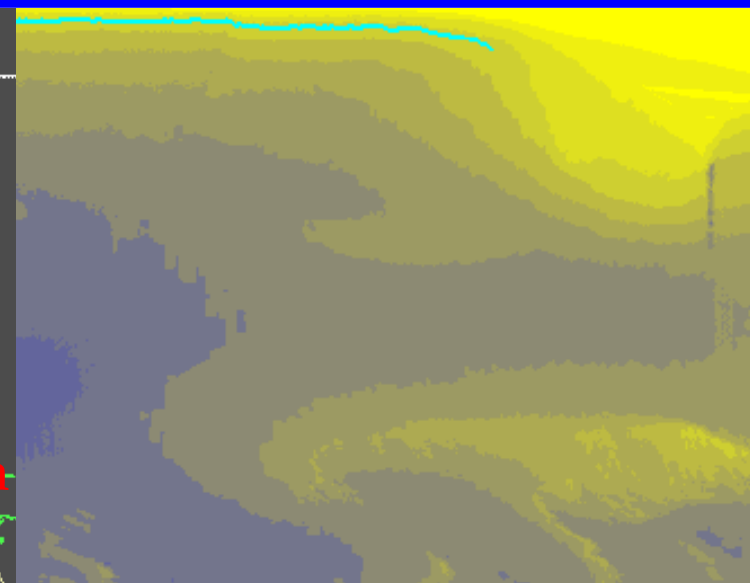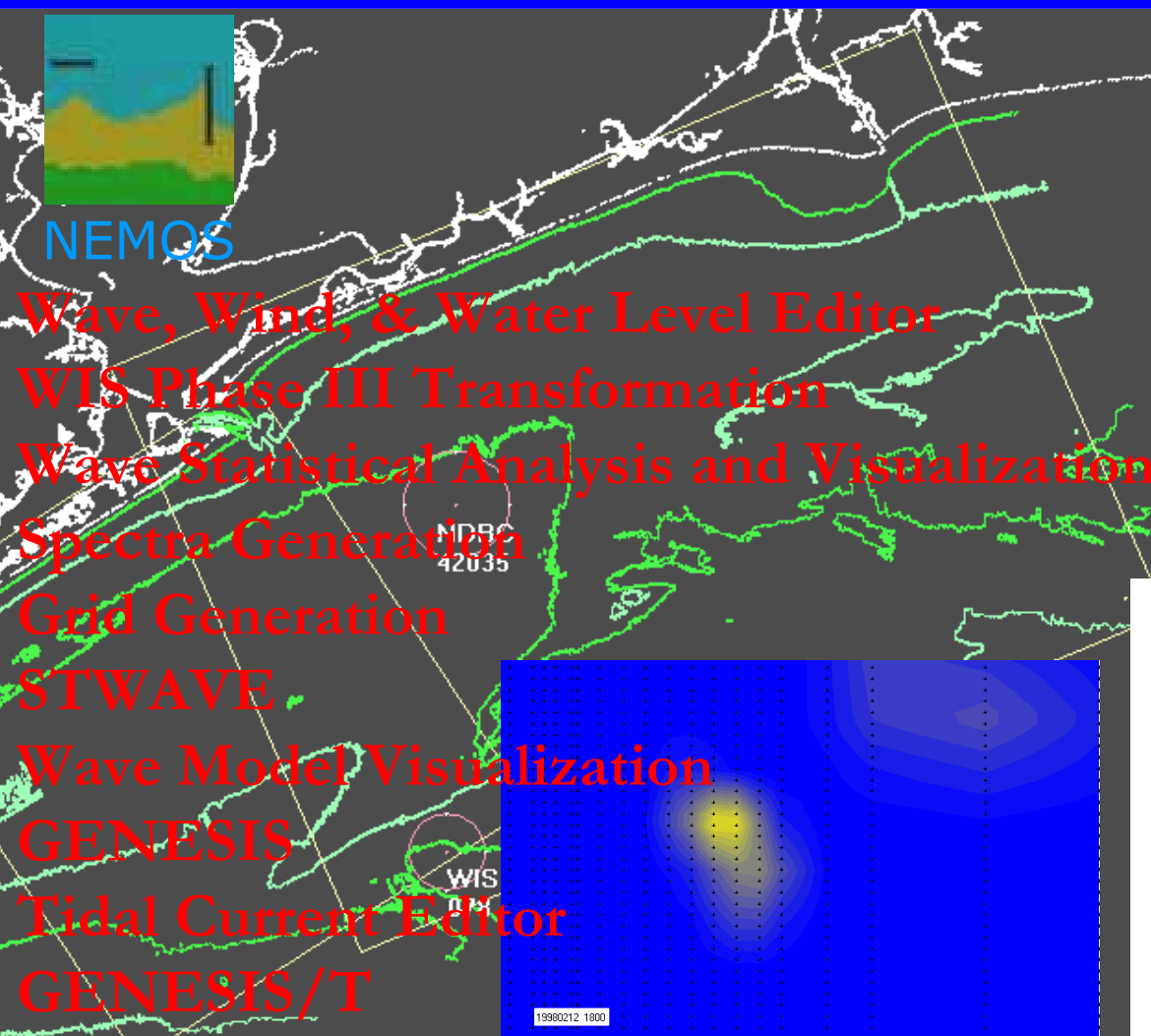
Basic Data Requirements

Bathymetry

Describes nearshore bathymetric irregularities that cause local transport gradients and produce non-uniform shoreline planforms.

Wave Information

Characterizes the primary environmental forcing producing longshore sediment transport and longterm shoreline planform change.

Shoreline position & beach properties

Provides required calibration data, initial conditions for forecast of shoreline change and/or project performance evaluations.
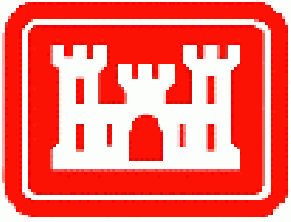
File-type Concepts

Configuration

Provides basic model setup and file association information.

Spatial Domain

Defines computation domain including all relevant spatial parameters such as structures, locations of engineering activities, etc.
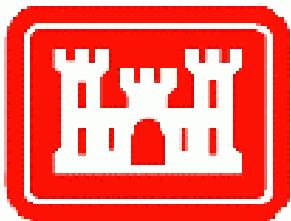
Visualization/Field

Output file containing major model results over the entire computational domain.

Station

Wave file; maybe time or integer indexed and represent offshore waves or results from nearshore wave transformation model.
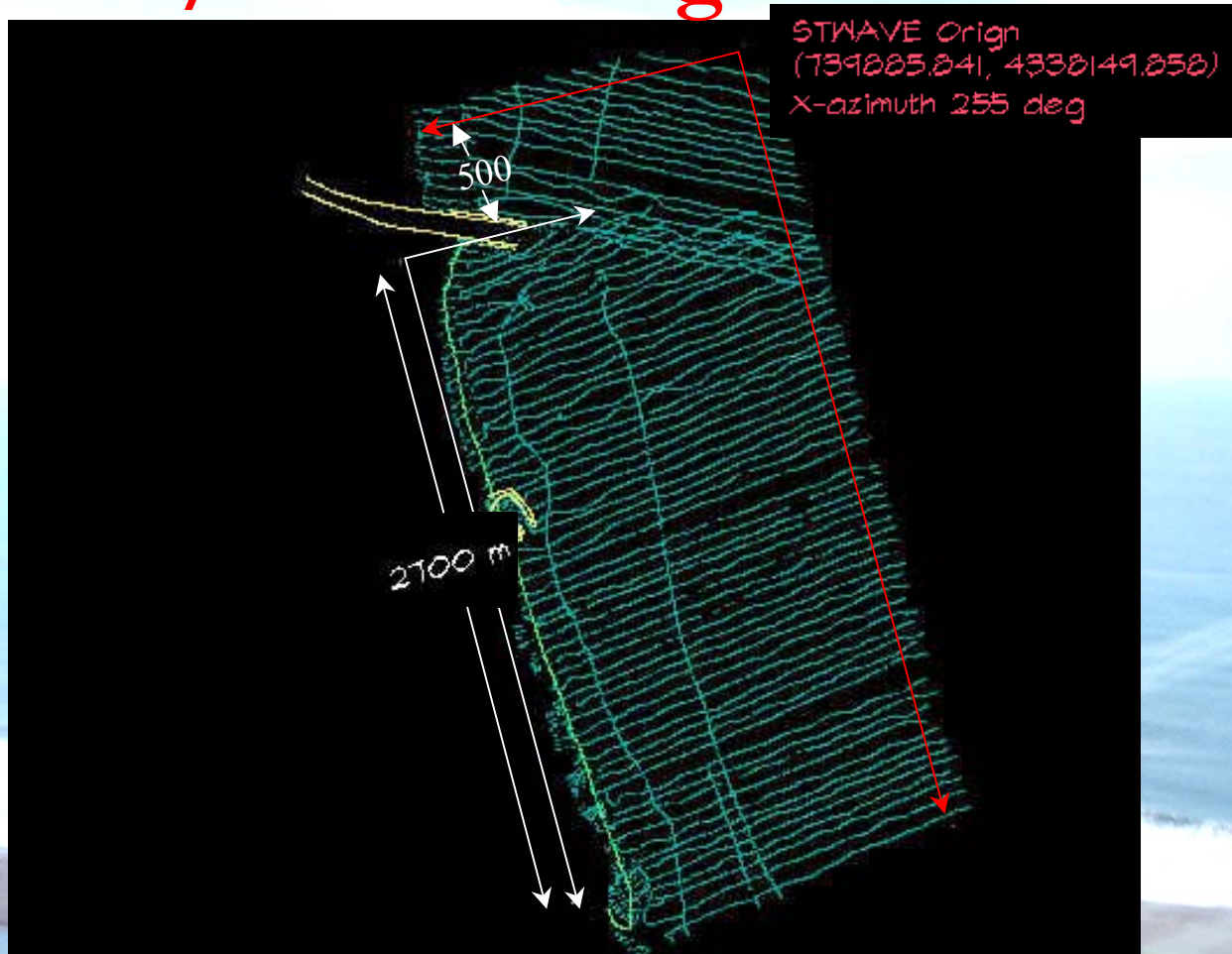
Printable output

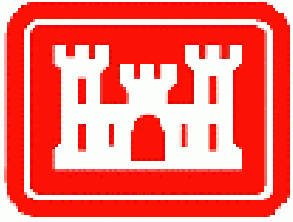Output file containing summary of model simulation and basic outputs.

Wave model/GENESIS grid relationships
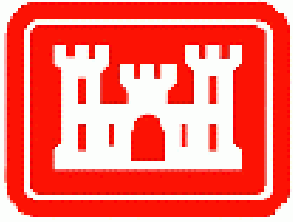
Nearshore Reference Line (Station file)

Wave information are passed from the wave model to GENESIS via the "Station" file. GENESIS requires wave information at cell wall 1, located DX/2 outside (left of) the GENESIS Y-axis. The NEMOS Grid Generation code allows automatic positioning of the GENESIS origin and axis based on user-specification of the wave model grid cell co-located with GENESIS cell wall 1 and the GENESIS X-axis. Wave model save stations are automatically selected via user-specified station depth and length of X-axis.
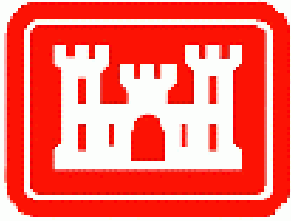
Procedures for Shoreline Change Modeling

- **Develop Offshore Wave Time Series**
  - ➢ Import to NEMOS
  - ➢ Statistically Analyze

- **Develop Input for Wave Model**
  - ➢ Grid generation
  - ➢ Input spectra

- **Configure Wave Model**
  - ➢ Model Settings / File associations
  - ➢ Simulate

- **Develop Input for GENESIS**
  - ➢ Configuration / Set-up
  - ➢ Calibrate / Verify
  - ➢ Simulate / Forecast

Develop Input for Wave Model
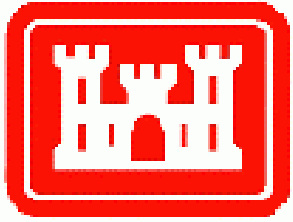
GRID GENeration, GRIDGEN

Import _bathymetry_ data, triangulate, inspect/modify, define grid region/generate grid, inspect/modify, save _Spatial Domain_ file. Specify station locations, inspect/modify, sort stations, save _Station_ file.

Wave Time Series, WWWL

Import _wave information_, transform (WISPH3), filter, statistically analyze (WSAV), save _Permutations_ file, generate input spectra (SPECGEN), save _Spectrum_ file.

Configure Model, STWAVE

Title, wind, and water level specifications, input and output file associations, save _Configuration_ file. Simulate, visualize (WMV).

Configuration

- Simulation title, units, Start/End dates, time step, animation time step.
- Offshore & nearshore wave, printable output, and visualization file associations.
- *Beach, sand,* & transport specifications
- Boundary conditions

Spatial Domain

- *Shoreline Position Information* – import, coordinate transformation, model reach preparation.
- Structures – position in grid, length, permeability, transmission, etc.
- Engineering activities – beach fill, bypassing, etc.
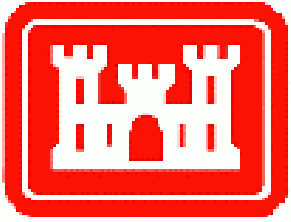
GENESIS Formulation
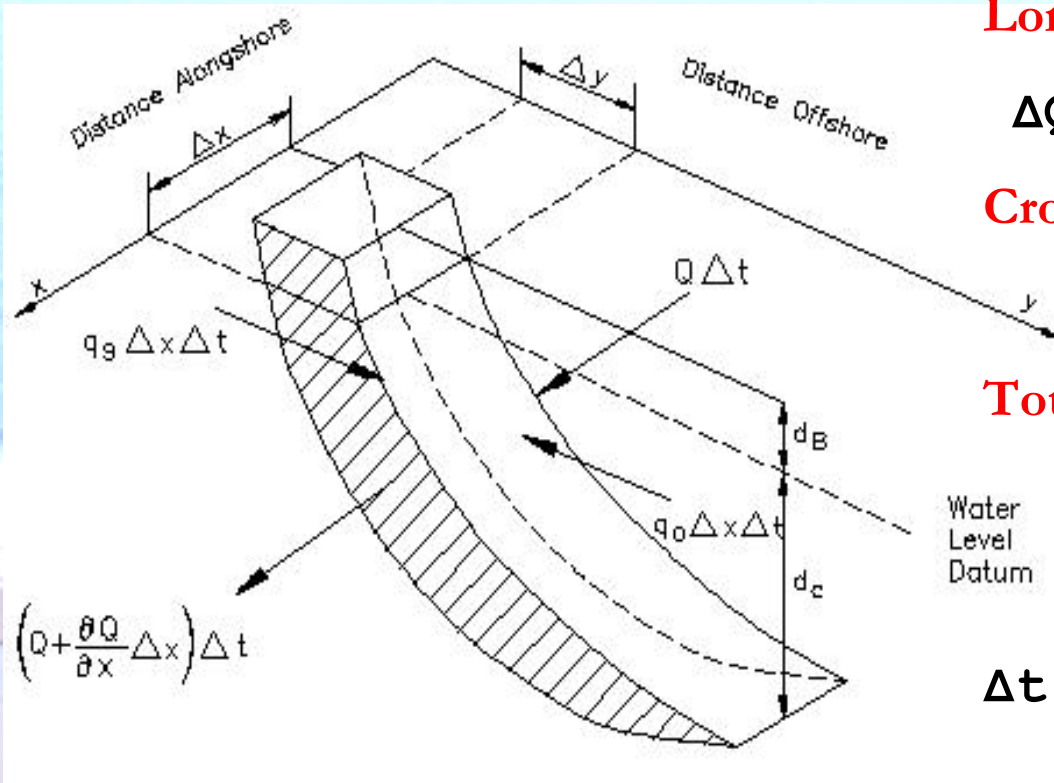
Longshore net volume change

$$\Delta Q \Delta t = (\partial Q / \partial x) \cdot \Delta x \Delta t$$

Cross-shore net volume change

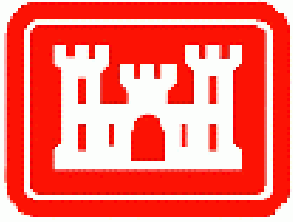$$\Delta q \Delta t$$

Total volume change

$$\Delta V = \Delta x \Delta y (D_B + D_C)$$

$$= (\partial Q / \partial x) \Delta x \Delta t + q \Delta x \Delta t$$

$$\Delta t \rightarrow 0$$

$$\frac{\partial y}{\partial t} + \frac{1}{(D_B + D_C)} \bullet \left(\frac{\partial Q}{\partial x} - q \right) = 0$$

When to use GENESIS/T?

Use **GENESIS/T** when the simulation will involve the development of tombolos.

GENESIS/T is formulated in the context of an explicit solution scheme, and requires shorter simulation time steps than would otherwise be required using **GENESIS** (implicit solution scheme).

GENESIS "T" enhancements – regional contours, tidal currents, and variable wave transmission at detached breakwaters will be implemented in **GENESIS**.